HIGHLY MIGRATORY SPECIES MANAGEMENT TEAM REPORT ON PERFORMANCE METRICS FOR THE 2016-2017 CALIFORNIA/OREGON LARGE-MESH DRIFT GILLNET FISHERY

In 2015 the Council took final action to recommend bycatch and protected species interaction management measures for the California/Oregon large-mesh drift gillnet (DGN) fishery. A regulatory component of that recommendation is the use of protected species hard caps; National Marine Fisheries Service published a proposed rule for those regulations on October 13, 2016 (81 FR 70660). The Council's action also included a non-regulatory component, annual fishery performance objectives. These provide a way for the Council to monitor bycatch and interactions with non-Endangered Species Act- (ESA) listed marine mammals in the fishery during each season compared to historical levels. If bycatch or protected species interaction levels are consistently at a level higher than one of the performance objectives, the Council could consider whether additional management measures are necessary to minimize bycatch or reduce protected species interactions in the fishery.

Numerical metrics were set for specified marine mammals not listed under the ESA, but with historically observed DGN fishery entanglements. There are also numerical metrics for billfish, prohibited sharks, hammerhead sharks, and manta rays based on recent catch levels in the fishery. For all finfish, the Council set a bycatch rate performance metric based on the overall retention rate (total number of fish that are landed, divided by all landed catch and fish thrown overboard dead). The Council chose a rate of 70 percent, which is also based on recent historical performance in the fishery.

The table below shows the results for the 2016-2017 fishing season, based on a simple ratio estimator which expands bycatch counts from 160 sets that were observed to an expanded bycatch estimate for 714 total sets. The only species for which the performance metric was exceeded was the northern right whale dolphin (shaded cell).

	Performance Metric	2016/2017 Fishing Season Results
Finfish Retention Rate	70%	88%
Minke whale	5	0
Short-beaked common dolphin	66	44.6
Long-beaked common dolphin	24	4.5
Risso's dolphin	7	0
California sea lion	97	4.5
Northern elephant seal	6	0
Northern right whale dolphin	11	26.8
Gray whale	5	0
Pacific white-sided dolphin	22	0
Billfish (other than swordfish)	26	17.9
Prohibited sharks (megamouth, basking, white)	2	0
Hammerhead sharks	4	0
Manta ray	2	0

Suitability of Ratio Estimator to Computing Performance Metrics for Species with Rare Event Bycatch

The 2016/2017 fishing season results were calculated using the simple ratio estimator, which was the method used to estimate bycatch and protected species interactions at the time the performance metrics were adopted. The ratio estimator uses the observer sample from a single year and assumes exactly the same bycatch rate in the unobserved portion of fishing effort as in the observer sample. The problems with estimating rare event bycatch from a single year of observer data are documented in a recent National Oceanic and Atmospheric Administration Technical Memorandum [1] and a recent Ecological Applications paper [2]. The result is an upward-biased estimator of rare-event bycatch in years when at least one bycatch event is observed and a downward-biased estimator when no bycatch is observed. This could be problematic for species where there have been many past years with zero observed interactions, such as the northern right whale dolphin.

While ratio estimators based on a single year's observer sample may be adequate for frequently caught species, a methodology which pools multiple years of observer data is essential for obtaining realistic estimates of bycatch per unit effort for the case of species with rare-event

interactions and limited observer coverage (Agenda Item E.3.a, HMSMT Report June 2015, Section 4.3 Observer Coverage Levels and Estimating Rare Event Bycatch). For example, by estimating bycatch rates over a longer time period and accounting for random variation in bycatch experience for the unobserved portion of effort, the random forest regression tree method [3], presented by Southwest Fisheries Science Center scientist James Carretta at the March 2017 Council meeting, avoids inherent problems with the ratio estimator of bias and imprecision.

The Highly Migratory Species Management Team recommends the Council consider whether the ratio estimator still constitutes an appropriate bycatch estimation method in rare-event and limited observer coverage circumstances, given the availability of better methodologies (i.e. Bayesian inference and regression trees) which address known shortcomings of the ratio estimator.

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[1] Carretta, J.V. and J.E. Moore. 2014. Recommendations for pooling annual bycatch estimates when events are rare. NOAA Technical Memorandum, NOAA-TM-NMFS-SWFSC-528. 11 p.

[2] Martin, S.L., Stohs, S.M., and Moore, J.E. 2015. Bayesian inference and assessment for rare-event bycatch in marine fisheries: a drift gillnet fishery case study. Ecological Applications, 25(2), pp. 416–429.

[3] Carretta, J.V., J.E. Moore, and K.A. Forney. 2017. Regression tree and ratio estimates of marine mammal, sea turtle, and seabird bycatch in the California drift gillnet fishery: 1990-2015. NOAA Technical Memorandum, NOAA-TM-NMFS-SWFSC-568. 83 p. doi:10.7289/V5/TM-SWFSC-568.

PFMC
06/01/17